class of relics, found in the neighborhood of Trenton, New Jersey. So far as the writer's experience in collecting goes, these hammer-stones are found away from the water, on the sites of villages, and more particularly on the sites of the operations of arrowhead makers. Curiously enough, too, the average weight of these hammer-stones is greater, as we have found them, than the average weight of those found at Muncy, Pennsylvania, by Mr. Rau. Always associated with the ordinary hammerstone, which is that with a depression on either side, for the ends of the thumb and second finger, is a smaller cylindrical hammer, of harder mineral, with nothing to indicate that it is a "relic," other than the well battered ends, which are as well marked in these specimens, as the similar batterings and finger pits are in the typical hammer-stones. — CHARLES C. ABBOTT, M. D.

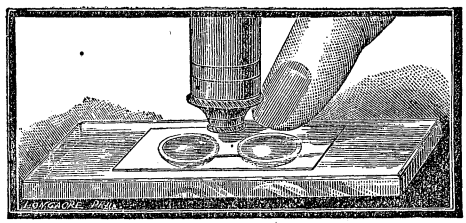
ANTIQUITY OF MAN IN AMERICA. — In the December number of this Journal we made an abstract of a paper printed by the Philadelphia Academy, in which Mr. Berthoud gave an account of the relics of an early race of men. As the geological position of the relics has been questioned, further information is very desirable.

MICROSCOPY.

A NEW SLIDE FOR THE MICROSCOPE.—At a recent meeting of the Optical Section of the Franklin Institute, there was described and exhibited in operation a new adjunct to the microscope, designed by Mr. D. S. Holman, a member of the section, whose life slide recently attracted so much attention and comment. The new device may be called a current cell, or moist chamber, and is designed to afford the microscopist the opportunity of observing and studying the constitution of the blood and other organic fluids with much greater ease and precision than it has heretofore been found possible to attain. The accompanying illustration will serve to make the description of its construction and operation manifest: The slide consists of a plain piece of plate glass of considerable thickness, and three inches by one in dimensions. This is furnished at equal distances from its centre with two well polished shallow cavities of circular form, which are connected with each other by one or more capillary channels. These channels are likewise polished, and to permit of a greater field in

focussing for their contents, the groove of the tube is made triangular in section, with one side forming a right angle with the surface of the slide, and the other forming with it a very large angle. The arrangement of the cell, or moist chamber, is as follows: In order that the current shall be most sensitive, the slide should first be brought nearly to the temperature of the body by holding it for a few minutes in the hand. A small quantity of the liquid to be examined (blood, for example), is then to be placed in each cell, and a thin cover glass placed upon them. If held down for a moment with the hands, the air within the cavities will become slightly rarified, and the cover glass so firmly held in place by atmospheric pressure as to require no artificial attachment. Upon removal of the fingers, it will be found that the centre of the cavities is occupied with a bubble of air, while a thin annulus about the circumference, as well as the connecting capillary tubes, is

Fig. 75.



occupied by the fluid. The slide is now ready for inspection. If placed beneath the microscope, and the instrument is focussed upon the connecting channel, a number of corpuscles, red and white, will be observed, but quite quiescent. Let the finger be now approached to the neighborhood of either cell, when at once a current, more or less rapid, according to its proximity, commences to flow beneath the object glass; remove the finger, and the direction of the current is reversed. The current is caused by the expansion of the air bubble in the cell, in consequence of the heat radiated from the finger; and its rapidity may be controlled to a nicety by regulating the proximity of the finger. So sensitive is the apparatus, that even with the highest powers, a corpuscle, granule or cell in the field of view, may be leisurely turned over and over in any desirable position, thus affording an unequalled means of observation and study to the microscopist; and while the eye is examining at leisure the behavior of the objects beneath it, the

mind is charmed with the simplicity of the means by which these motions are controlled. In the cell here described, no foreign liquid is added to the material under examination. Moreover, if each cell be entirely filled, but with liquids of different densities, the cell holding the denser liquid being placed slightly uppermost upon the rotating stage of the microscope, the action of gravity will cause two currents to flow in opposite directions through the communicating channels, and in this way the phenomena of transfusion, crystallization, etc., may be observed for a considerable length of time, which otherwise are brought to sight only with difficulty. At the conclusion of the description, the ingenious and useful device was highly praised by those members present, who were best able to appreciate its value, and its exhibition beneath the microscope was the occasion of much interest.

Aerial Stage Micrometers.—Dr. Pigott has called the attention of the Royal Microscopical Society to a novel mode of using micrometers. He places the micrometer below the achromatic condenser, and thus employs its image as a stage micrometer, focussing the condenser so as to make the image of the micrometer coincide with the plane of the object on the stage. This remedies the greatest defect of other stage micrometers (as Fraunhofer's), since the accuracy which is necessarily diminished in proportion to the magnifying power employed, is at the same time increased by the whole amplifying power of the achromatic condenser. Hence this arrangement more nearly resembles in accuracy the ocular micrometers, and it might with nearly equal propriety be called an eye-piece micrometer, since its second image is formed in the ocular along with that of the object. It possesses the valuable property of reading off the size of objects directly, without troublesome computation and without allowance for the power of the ocular. Either the cobweb micrometer or the lines ruled on glass may be used, and the arrangement should be such that the micrometer lines should appear on the stage in precisely a definite proportion of their natural size. An accuracy of $\frac{1}{120000}$ of an inch is theoretically quite attainable by this plan. With the cobweb micrometer this arrangement seems nearly faultless, save the first trouble of combining the apparatus so as to get a perfectly accurate reading: but, with lines on glass, the glass plate, with its imperfections as well as its lines, necessarily gives an image which

is perhaps as annoying as if the plate, instead of its image, were in the focus of the eye lens.

THE MICRO-SPECTROSCOPE. — Dr. E. J. Gayer has contrived and published in the Transactions of the Royal Microscopical Society, a micro-spectroscope consisting of a collimating lens and one or more prisms occupying the position of the ocular, and immediately above these a telescope, suitably inclined, for examining the spectra. According to Hogg, and other authorities, the first application of the spectroscope to the microscope was made by Mr. H. C. Sorby who placed a triangular prism below the stage, the object being situated in the spectrum. As this was inapplicable to opaque objects, Mr. Huggins proposed to adapt a direct vision spectroscope to the ocular, which he accomplished by inserting the collimative-tube of a star spectroscope into the body of the microscope in the usual position of the eye-piece. The Sorby-Browning contrivance has so completely superseded these arrangements that they have been nearly forgotton, and Dr. Gayer has rediscovered Mr. Huggins' arrangement without knowing it. He combines with it the Sorby-Browning plan of adding a side stage for the comparison of spectra, and seems to secure an increase of light by placing the slit nearer the objective, about an inch above it. On the other hand, those most familiar with the Sorby-Browning eye-piece form, claim that it has sufficient light and dispersion for its use, and that its absorption bands are not only wide enough but more distinct than if magnified by a telescope.

BLIGHTS ON TEA AND COTTON. — Mr. M. C. Cooke describes a new species of fungus occurring on blighted leaves of the tea plant, from Cachar, India. "*Hendersonia theæcola* Cooke, Perithecia globose, black, prominent, pierced at the apex, scattered over both surfaces, or subgregarious; spores cylindrical, rounded at the ends, triseptate, pale brown, on long hyaline pedicels (.0004–.0005 in.), .01–.0125 millimetres long without the pedicels: on leaves of *Thea*." Picking off the diseased leaves and burning them is the only remedy suggested for this blight, which shares with the punctures of an unknown insect the credit of destroying the plants.

Seeds of American cotton naturalized at Dharwar, India, affected with "Black blight," manifested but little injury externally, but on being crushed were found to be filled with a sooty powder appearing like the spores of an *Ustilago*. On closer examination

Mr. Cooke became satisfied that the spores were originally concatenate, though soon breaking up into subglobose individuals, and he therefore describes them as a new species of *Torula* (*Torula incarcerata* Cooke) notwithstanding their anomalous habitat. As a *Torula* it must be considered a sequence rather than the cause of the decay of the seed, while the opposite would be fairly presumed of an *Ustilago*.

Iridescent Engraving. — Mr. Rutherford of New York, long ago contrived a machine, worked by an electro-magnetic engine, which ruled upon glass microscopical test objects consisting of lines of iridescent fineness; and the beautiful iridescence of Nobert's lines by opaque or dark-field illumination is almost as familiar to microscopists as that of mother-of-pearl or of some of the diatoms.

Recently Mr. Wm. A. Rogers of the Cambridge Observatory has engraved upon glass, lines of great beauty and considerable fineness. Those of medium fineness, especially, glisten beautifully with rainbow-colored light. The lines from $\frac{1}{32}$ inch to $\frac{1}{24000}$ inch, suitable for use in optical instruments as a substitute for spider-web or diamond rulings on glass, are remarkably clear, distinct and uniform in their spacing; while the finer lines excel in fineness and distinctness any engraving previously seen by the writer. Those of $\frac{1}{20000}$ inch are perfectly successful, while those of $\frac{1}{24000}$ inch are capable of being defined and counted. Some of Mr. Rogers' engraving are made in stars like Mr. Stanistreet's lines.

Apertures of Objectives. — The Tolles' $\frac{1}{10}$, sent to London as proof of the utilization of more than 82° aperture in balsam, has been carefully examined by Messrs. C. Brooke, H. Lawson, W. J. Gray and S. J. M'Intire, who report an angle in air of 145°, in water 91°, in balsam 79°. Mr. Wenham believes the balsam angle might have been three degrees higher in hard instead of fluid balsam. Doubtless four more competent judges could not have been selected in the world, and their report will be likely to be generally accepted unless it can be shown that a higher angle might have been utilized at some other point of practically useful adjustment, a question which they can scarcely have failed to consider in preparing the report.

Under-corrected Objectives.—The advantage of these lenses, which have only lately attracted much attention, was distinctly and practically acknowledged by Mr. Wales in the year 1865. At that

time he patented his well known objectives with two backs; one back being calculated to give a result of perfect correction for color, this being required by many microscopists, and being desirable for many kinds of work; and the other back having the lens slightly undercorrected for color, for better performance in photography and in extreme resolution by oblique light. It was, and is, claimed by Mr. Wales that such combinations furnish to microscopists a really valuable choice of qualities and of working power in objectives.

STUDENTS' MICROSCOPES. — Since the publication in this Journal of a paper on the above subject, J. W. Queen & Co. have greatly improved their model of students' microscope, availing themselves liberally of the modern suggestions on the subject. They have also introduced, under the name of Popular Microscope, a simplified and cheapened form which seems fully equal to the old style of students' stand. Experienced microscopists will be the first to appreciate the efforts of manufacturers to furnish really good instruments at a price which will render them popular and thereby extensively useful.

A NEW OCULAR MICROMETER. — Dr. Pigott advises that the lines of an eye-piece micrometer be engraved on a plano-convex lens of long focus, such as a spectacle glass. As he explains that the convexity is too slight to appreciably alter the effect of the ocular, this form can only excel in ease of obtaining accuracy of workmanship, as compared with the commonly used contrivance of a stage micrometer cut down to such size as to lie in the focus of the eye-lens.

BLOOD-DISKS OF THE SALMON. — Mr. George Gulliver called the attention of the East Kent Natural History Society to the preëminent size among osseous fishes, of red corpuscles of the blood of the salmon family, those of *Salmo fontinalis* having a mean length of $\frac{1}{1455}$ inches and breadth of $\frac{1}{2289}$ inches. On account of this peculiarity of size, "Science Gossip" aptly suggests the choice of this blood to novices in microscopy who desire to study the blood of fishes.

THE HIGHEST POWER. — Messrs. Powell & Lealand have completed and exhibited a one-eightieth inch objective which has an angular aperture of 160°, works through glass covers .003 thick,

and is fairly up to its nominal power, giving an amplification of 4,000 with the lowest ocular. It is said to give sufficient light and good definition. Its working properties are little known at present.

Red Blood Corpuscles. — Mr. Malassez notices a general tendency of these bodies to diminish in number and increase in size in the lower animals. The following figures indicate the estimated number to a cubic millimetre; in the goat, 18,000,000; in the camel, 10,000,000; in man, 4,000,000; in the porpoise, 3,600,000; in birds, 4,000,000 to 1,600,000; in osseous fishes, 2,000,000 to 700,000, and in cartilaginous fishes, 230,000 to 140,000.

Nature of Markings. — Dr. Pigott believes the spherules of butterflies' scales to be more difficult of resolution than equally separated lines in Nobert's bands. On the other hand, it has been believed that diatom markings were more easily resolved than Nobert's lines of equal fineness; a difference which, if confirmed, might give some hint as to the nature of the various markings.

Microscopic Toys. — Mr. T. Curtiss sent for exhibition at a meeting of the Brighton and Sussex Natural History Society, slides consisting of a variety of figures of flowers, insects and birds, artificially formed of beautifully arranged scales of butterflies and moths. Some of the figures consist of as many as 400 scales, and all were considered wonderfully perfect and beautiful.

The Value of Illumination. — Mr. Hogg stated, at a meeting of the Royal Microscopical Society, that with Wenham's new illuminator he resolved *N. rhomboides* very satisfactorily with a $\frac{1}{4}$ objective made by Andrew Ross twenty-five years ago. Probably this was a $\frac{1}{5}$ by present nomenclature.

A New Society. — A "Medical Microscopical Society" has been organized in London, under the presidency of Mr. J. Hogg.

NOTES.

The daily press has made us familiar with the facts, so far as known, regarding the death of Capt. Hall of the Polaris. His ship penetrated two hundred and sixteen miles (Lat. 82° 16′) farther north than Dr. Kane, or in fact any other vessel. Capt. Parry attained a more northern point by means of sledges. Hall